
N/Protein Determination in Feed according to Dumas combustion method

Reference: **AOAC 990.03** Protein (Crude) in Animal Feed Combustion Method

Tested with **VELP Scientifica NDA 701 Dumas Nitrogen Analyzer** (Code F30800070)



Introduction

Protein is a critical nutrient in cattle, pig, poultry, sheep, horse and pet foods.

Although protein supplements are high cost they are sometimes necessary in order to meet the animal's nutritional requirements. An adequate protein content in feed products is important for animal health and productivity, as well as for ranch profitability. The protein requirements of cattle vary with age, size, and expected performance.

During lactation, larger cattle typically require more pounds of crude protein per day than smaller animals, but as a lower percentage of their total dry matter intake. In other words, lighter cattle require higher quality feeds and forages at lower quantities compared with heavier cattle. Cattle requirements for crude protein rise with increasing lactation and rate of gain. Protein is required for milk production and reproductive tract reconditioning after calving.

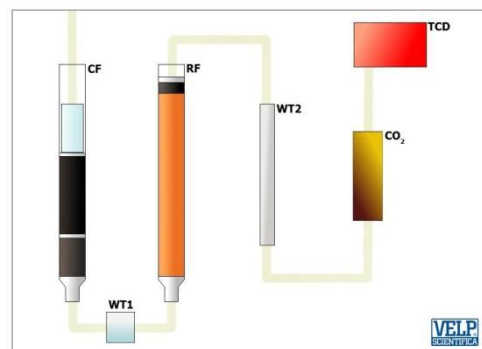
Protein Determination in Feed

The Dumas method starts with a combustion furnace (CF) to burn the sample, obtaining elemental compounds.

Water is removed by a first physical trap (WT1 - **DriStep™**), placed after the combustion, and a second chemical one (WT2). Between the two, the elemental substances passed through a reduction furnace (RF).

The auto-regenerative CO₂ adsorbers (CO₂) let pass only the elemental nitrogen that is detected by the **LoGas™** innovative Thermal Conductivity Detector (TCD) with no requirement for a reference gas.

The NDA 701 is controlled via PC through the intuitive **DUMASoft™**.



NDA 701 Preliminary Operations (daily)

Follow the operating manual to start the NDA 701 and check that the following parameters are set:

Temperature Combustion reactor (Code A00000158): 980 °C

Temperature Reduction reactor (Code A00000226): 580 °C

Flow rate MFC1 He: 190 ml/min

Flow rate MFC2 He: 200 ml/min

Condition the system by testing 2 EDTA standard (Code A00000149) and 3 to 5 empty tin foils (Code A00000153) as Check up.

Verify the calibration curve with one or more tests as Standard by testing the same standard used for the curve creation.

Sample Preparation

Grind the test samples using a grinder to suitable fineness (particle size ≤ 0.5 mm) to obtain $\leq 2,0$ % relative standard deviation (RSD) for 10 successive nitrogen determinations.

Using a spatula, put the sample directly into the tin foil.

Close the tin foil, obtaining a capsule.

Load the capsule into the autosampler.

Analysis Procedure

Fill the following fields in the database: **Sample name, Weight, Method, Sample type, Calibration number**

The "FEED FOR ANIMALS, DRY" method shows the following parameters:

Protein factor: 6.25

O₂ flow rate: 400 ml/min

O₂ factor: 1.6 ml/mg

The "SOYA BEAN" method shows the following parameters:

Protein factor: 5.70

O₂ flow rate: 400 ml/min

O₂ factor: 1.8 ml/mg

Press  to start the analysis.

Analysis time: from 3 minutes for one run.

Samples:

Animal's feed products:	Indicative protein content:
1- Poultry ration	18.0 %
2- Pork feed	30.0 %
3- Dog food, dry	24.0 %
4- Fish feed, wet	45.8 %
5- Soy meal	38.0 %

Typical Results on Feed Products

The results are calculated as a percentage of nitrogen and percentage of protein.

Sample	Sample quantity (mg)	Nitrogen %	Protein %
Poultry Ration	103.2	2.863	17.894
	102.1	2.884	18.025
	100.1	2.898	18.111
	Average ± SD%	2.882 ± 0.018	18.010 ± 0.109
	RSD% *	0.611	0.607
Pork Feed	101.00	4.830	30.185
	96.10	4.817	30.108
	99.90	4.823	30.142
	Average ± SD%	4.823 ± 0.007	30.145 ± 0.039
	RSD% *	0.135	0.128
Dog Food, Dry	99.90	3.883	24.266
	99.60	3.805	23.780
	102.70	3.843	24.021
	Average ± SD%	3.844 ± 0.039	24.022 ± 0.243
	RSD% *	1.015	1.012
Fish Feed, Wet	50.20	7.378	46.110
	50.50	7.341	45.880
	47.60	7.312	45.700
	Average ± SD%	7.344 ± 0.033	45.897 ± 0.206
	RSD% *	0.450	0.448
Soy Meal	99.40	6.072	37.949
	99.20	6.026	37.664
	98.70	6.122	38.265
	Average ± SD%	6.073 ± 0.048	37.959 ± 0.301
	RSD% *	0.791	0.792

Protein Factors: 6,25 for feeds and 5,70 for soy meal

* RSD% = (Standard Deviation * 100) / Average

Conclusion

The obtained results are reliable and in accordance with the expected value.

The combustion method, relying on the Dumas principle, for the determination of total nitrogen in different kind of feeds, has been included as an official alternative to the Kjeldahl method.

Results have been obtained with the following calibration curve: in a range of 0 - 9 mg N with 5 measurements of EDTA standard (%N = 9,57) (Code A00000149).

Benefits of Dumas combustion method are:

- High productivity, non-stop performance
- Time saving, few minutes required
- Moderate running costs
- Totally unsupervised, fully automated
- Omission of harsh and toxic chemicals
- Eco-friendly, low amount of residues and wastes

Several organizations working with standardization and recommendation of chemical methods have approved combustion methods for the determination of nitrogen.

Thanks to development in sophisticated instrumentation, the Dumas principle, became a practical and popular alternative for the determination of nitrogen in organic matrices.